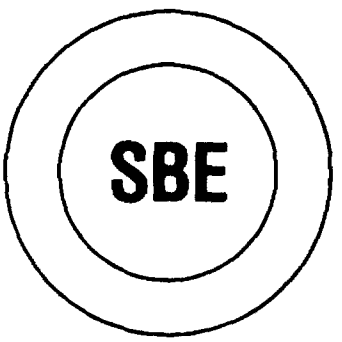
Comments of the Society of Broadcast Engineers, Inc.

ET Docket 95-18
Allocation of Spectrum at 2 GHz for Use by the Mobile-Satellite Service



May 5, 1995

SOCIETY OF BROADCAST ENGINEERS, INC.
Indianapolis, Indiana

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Section 2.106 of the	)	ET Docket No. 95-18
Commission's Rules to Allocate	)	
Spectrum at 2 GHz for Use by	)	
the Mobile-Satellite Service	)	

To: The Commission

Comments of the Society of Broadcast Engineers, Inc.

The Society of Broadcast Engineers, Incorporated (SBE), the national association of broadcast engineers and technical communications professionals, with more than 5,000 members in the United States, hereby respectfully submits its comments in the above-captioned Notice of Proposed Rule Making (NPRM) relating to the allocation of 2 GHz spectrum for the Mobile-Satellite Service (MSS).

I. 2 GHz Television Broadcast Auxiliary Bandwidth Should Not Be Reduced

1. The spectrum now allocated to 2 GHz Television Broadcast Auxiliary Electronic News Gathering (ENG) Channels A1 (1,990–2,008 MHz) and part of A2 (2,008–2,025 MHz) has been re-allocated internationally to MSS. Further, the United States has already agreed, at the 1992 World Administrative Radio Conference (WARC-92), that this spectrum will be made available for domestic MSS use by January 1, 2005.

2. The 2 GHz ENG spectrum is used extensively by television broadcast stations, by Broadcast Network Entities such as ABC, CBS, FOX, NBC, and PBS, and by Cable Network Entities such as CNN and ESPN. In the major markets, where the 2 GHz ENG spectrum is particularly congested, broadcasters have voluntarily transferred virtually all fixed links to the 7 and 13 GHz Television Broadcast Auxiliary bands so as to make the seven 2 GHz channels available for mobile ENG use. The 2 GHz band is favored over higher bands because of its superior propagation characteristics, which allow shots through foliage and "building bounce" paths in order to relay news feeds from the field, where the luxury of engineered microwave paths, free of obstructions and with adequate Freznel zone clearance, are often not possible.

3. Longer paths are possible at 2 GHz, compared to the 7 and 13 GHz Television Broadcast Auxiliary bands, when restricted to using antennas that may be practically mounted on vehicles. ENG "live shots" of 40 to 50 miles are not only possible, but are everyday occurrences in the major television markets. Many major market stations have established multiple ENG receive sites on tall buildings or mountain tops, with remotely-controlled, steerable receiving antennas, so as to provide the ability to relay incoming ENG feeds originating over wide areas. Some ENG vans are even equipped to operate as a temporary relay station, where the relay van is driven to an appropriate site with line of sight to both the originating ENG van and to a fixed receive site used by the parent station. Network Entities also often establish temporary ENG receive sites during coverage of events. These remote ENG receive sites then relay the ENG signal to the station's studio for editing, using point-to-point Inter City Relay (ICR) links in the 7 and 13 GHz Television Broadcast Auxiliary bands, or, in some cases, by dedicated, hard-wired coaxial cable or fiber optic links, or even by satellite relay.

4. The television broadcast industry has made the seven ENG channels work as a result of an exceptional system of voluntary frequency coordination and sharing. SBE has long encouraged this effort, and sponsors approximately one hundred volunteer frequency coordination groups nation-wide. In many major markets the "home channel plan" is used, where one 2 GHz channel is "assigned" to a particular station on a primary basis, with other users sharing the channel on a prior coordination basis. Because television stations make the heaviest use of their ENG channels during weekdays, whereas visiting network entities often only need these channels on weekends or holidays, for sporting events, it has been possible, due to coordination efforts approaching the heroic, for both television stations and network entities to meet their respective needs with no new 2 GHz spectrum.

5. Another reason why broadcasters have been able to coexist with a mere seven ENG channels is the "safety valve" effect of spectrum borrowing. Under spectrum borrowing, spectrum from the 2,290–2,300 MHz Space Research band, from the 2,300–2,310 MHz Amateur Radio band, from the 2,310–2,390 Flight Test/mobile radiolocation band, and from the shared 2,390–2,450 MHz Flight Test/Amateur band, have been used on a case-by-case, Special Temporary Authority ("STA") basis.[1] However, exactly because such event-specific

[1] For example, Capital Cities/ABC, Inc. has obtained STAs to operate in the 2,310–2,390 MHz Flight Test band to allow coverage of the New York City Marathon, the 1995 Super Bowl in Miami, and the January, 1993, Presidential Inauguration, as well as numerous auto races, and to also operate in the shared 2,390–2,450 MHz Flight Test/Amateur band to allow coverage of the Indianapolis 500 auto race.

spectrum borrowing has so far been possible on a case-by-case basis, there is no guarantee that this additional spectrum will continue to be available. Indeed, because of the very pressures now threatening broadcasters' 2 GHz ENG spectrum, broadcasters are less likely to be able to continue to "pull a rabbit out of a hat" by using borrowed spectrum.

6. The extreme frequency congestion in the 2 GHz ENG band has been independently acknowledged in a recent (March, 1995) report prepared by the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce, "U.S. National Spectrum Requirements, Projections and Trends." At Page 76 of that report, NTIA correctly notes that

> The AUXBC bands are already crowded and will become more so, mostly because of the need to simultaneously transport NTSC and HDTV signals and the increasing use of ENG for local news coverage.

The NTIA report concludes that digital signal compression will be used to squeeze in some additional ENG and STL links. However, for reasons provided in these instant comments, SBE believes that NTIA is being overly optimistic in its assessment that digital compression will be able to solve the broadcasting industry's needs, especially in the short term (*i.e.*, the next five years).

7. Similarly, at Paragraph 16, Page 8, of the First Report and Order and Third Notice of Proposed Rule Making to ET Docket 92-9, concerning setting aside of spectrum for emerging technologies, the Commission stated

> We also remain convinced that exclusion of the 2 GHz BAS and MDS bands is correct. As the staff noted in the Spectrum Study, the BAS bands are used for both fixed and mobile operations in support of television programming. The only candidate band for relocation of BAS operations- 6.875-7.125 GHz- already is allocated to BAS and likely would not be able to accommodate substantial numbers of 2 GHz operations. Also, according to the Society of Broadcast Engineers, Inc., many 2 GHz fixed broadcast auxiliary links have voluntarily relocated to higher bands, thus freeing spectrum for difficult to relocate mobile 2 GHz BAS operations (e.g., electronic news gathering). Further, as noted by the National Association of Broadcasters, the Association for Maximum Service Television, Inc., and others, the expected implementation of advanced television service will increase substantially the demand for BAS spectrum.

8. It is clear, therefore, that the existing 2 GHz ENG channels are stretched to the limit in the major markets, and the loss of two of the seven channels, as one of the options now proposed, would be a devastating blow. SBE argues that the most logical and fairest option

to broadcasters is to shift the band upwards by 35 MHz, so as to provide no net loss in the bandwidth available to broadcasters.

II. More Spectrum Efficient Use of the 2 GHz ENG Band Is Not Yet Practical

9. The NPRM has raised the possibility that broadcasters could "make do" with the loss of ENG Channels A1 and A2 by using the remaining spectrum more efficiently. However, there are numerous technical reasons why such a solution is not possible, as follows:

9.1. **Need for Contribution Quality Rather Than Relay Quality Signals.** Signals from mobile ENG stations need to be contribution quality rather than merely relay quality. Contribution quality signals are signals that are capable of surviving downstream editing and further relaying, so that the signal ultimately delivered to the transmitter, for final distribution to viewers, is of acceptable quality. Broadcasters typically add captioning (both closed and open), subtitles, graphics, video effects, and any number of other modifications to the picture, before ultimately relaying the signal to the transmitter. Recording and playback of incoming ENG signals in slow motion to allow detailed analysis is particularly demanding of picture quality. In contrast, relay quality signals are signals not intended for subsequent editing and additional relaying; they can, therefore, be less robust and still provide an acceptable end product. It is for this reason that the industry uses FM video analog transmissions for ENG, requiring a 17 MHz bandwidth, rather than the ghost and noise-prone vestigial sideband AM format, requiring only a 6-MHz bandwidth, and which is used for over-the-air television.

9.2. **Reducing Deviation of FM Video Links Is Not Always a Viable Solution.** Although the frequency deviation of FM video signals can be reduced, with a proportional loss in quality and signal-to-noise ratio, this technique only works where there are no strong adjacent channel signals, the two reduced-deviation feeds are of approximately equal amplitude, the two signals are cross-polarized to each other, the 40% reduction in signal-to-noise ratio can be tolerated, and the use of only a single audio subcarrier (typically at 4.8 MHz) can be tolerated (*i.e.*, monaural operation).[2] In markets like Los Angeles broadcasters are often forced to various forms of narrow band ENG operations using only the 4.8 MHz

[2] The majority of modern-day ENG fixed receivers have two user-selectable IF bandwidths of 10 and 15 MHz. The 10 MHz narrow IF bandwidth is used where split-channel operation can be accommodated, and the 15 MHz bandwidth is used where full-deviation, multiple audio subcarrier feeds are needed. For split-channel operation, the center frequencies of the two feeds sharing a single channel are typically offset by 4.5 MHz from the channel center; *e.g.*, split-channel operation on ENG 2 GHz Channel A4 (2,042–2,059 MHz) would have the two reduced-deviation FM video signals centered on 2,046 MHz and 2,055 MHz.

audio subcarrier to make their Home Channel Plan work. Everyone acknowledges the significant impairment of quality forced upon them by too many users and too little spectrum, and no one likes it. Such "quality hits" will soon become noticeable to home viewers if narrow band ENG becomes the rule rather than the exception.

9.3. **Digital Is Not Yet a Solution**. Like the still unfulfilled, "blue sky" predictions and promises reminiscent of the cable television industry in the early 1980s, assuring sometimes naive local franchising bodies that every home would soon have universal cable service, and that subscribers could accomplish their banking needs, book airline reservations, and other tasks, all using their set-top converter, SBE believes that bandwidth-saving digital techniques will not be a practical and proven solution anytime soon. Digitizing an analog signal *increases* rather than *decreases* the required bandwidth. Thus, any technique using digital signals in order to obtain a net bandwidth reduction must employ compression techniques on the digitized signal. Although television signals are candidates for such compression techniques, due to the often repetitive nature of both National Television Standards Committee (NTSC) and advance television (ATV) signals, there are limits to this technique.

9.4. **Digital Compression Algorithms Are Lossy**. First, it must be realized that digital compression techniques are "lossy." If only moderate amounts of digital compression are employed the re-constructed signal at the receiving end can still be of contribution quality. However, if massive amounts of compression are used, so as to "squeeze" the signal into a narrow bandwidth, then the expanded and re-constructed signal at the studio end will no longer be of contribution quality.

9.5. **The Amount of Practical Digital Compression Depends Heavily on Picture Content**. Second, the amount of digital compression that can be applied to a digitized NTSC signal, with acceptable results at the other end, is very sensitive to the amount of motion in the picture. Pictures with little movement, such as character generated screens or "talking heads," might well survive compression to a 6-MHz bandwidth (or even less) with acceptable quality. However, signals with significant motion, such as sporting events and many news feeds, are poor candidates for heavy compression. Massive amounts of compression would cause obvious and unacceptable artifacts in the re-constructed signal.

9.6. **Digital Compression Equipment Has Significant Physical and Operational Restraints**. Third, actual production equipment, capable of digitizing and compressing an NTSC signal to 6 MHz of bandwidth with contribution quality at the receiving end, does not

yet exist. SBE notes that such devices have been promised as "just around the corner" for at least the last three years. Indeed, Motion Picture Experts Group II (MPEG-2) professional profile standards are still under development (only MPEG-2, main profile at main level, a 4:2:0 color components digital standard, requiring 126 MBs uncompressed, and suffering from color smearing, even with no compression, is currently complete).

9.7. **Many ENG Uses Will Be Incompatible With These Restraints**. Fourth, although SBE fully expects that such equipment will ultimately become available, its size, power draw, and latency effects will make it incompatible with many existing ENG applications, such as battery-powered man-pack units on the floors of national political conventions, and units mounted on race cars, toboggans, and similar high-speed sporting craft. Latency effects become a concern because of limitations on subsequent downstream camera switching and editing capabilities and because of the time required to compress and de-compress a digitized signal; in the extreme case, this could require a whole new system of interruptable feed back (IFB) between on-air talent, producers, and news crews, to allow real-time communications and adjust for noticeable time-delays between various incoming signals.

9.8. **Greater Fragility of Compressed Signals**. Fifth, SBE believes that any signal that has been heavily compressed will inherently be more "fragile" that its uncompressed counterpart. Although this may not be a problem on "engineered" point-to-point paths, it is likely to be a severe problem on many less-than-perfect ENG paths shooting through foliage or bouncing off an available high-rise building in order to establish a feed to the closest available ENG receive site. Freeze frames and jumpy video are more objectionable than noise or double images (ghosts). Another unknown is dropouts in digital audio when the picture is frozen.

10. If broadcasters are forced to higher microwave bands for ENG, the costs of the extra ENG receive sites will pose a serious threat to local news operations. Many more ENG receive sites will be needed. More microwave back-haul links will be needed. Forcing ENG into a "microcell model," as if it had the economic base of thousands of cellular phone users, simply will not work. Broadcasters have no practical way to pass along such costs to their end users (viewers of free local programming), as if they were cellular phone customers.

11. The added irony is that such a move would force broadcast ENG operations back into conflict with fixed, point-to-point Television Broadcast Auxiliary links that have been moved, at great expense and trouble, to the 7 and 13 GHz Television Broadcast Auxiliary bands.

12. The net effect of shorter ENG path lengths at higher frequencies will be significantly higher costs to broadcasters, and an obscenely elevated level of spectrum inefficiency. The main benefactors of this process will be those who wish to force local stations out of the live news gathering business, entrepreneurs who see MSS as a lucrative business at the expense of free, over-the-air television, and the U. S. Treasury, as the short-term benefactor of spectrum auctions.

III. MSS Industry Should Be Required to Bear All Costs of Shifting the ENG Band

13. For the above reasons, SBE believes that by far the best and fairest option is for the 2 GHz ENG band to be shifted upwards by 35 MHz, so as to cause no net loss in available bandwidth. This, in turn, raises several issues, as follows:

13.1. **Need To Modify All ENG Equipment.** All 2 GHz ENG transmitters and receivers will need to be modified, and not just those operating on Channels A1 and A2. Virtually all ENG equipment uses frequency synthesized tuning, to allow operating on any of the seven ENG channels. In order to not obsolete this equipment, all such transmitters and receivers will need to be modified to operate in the shifted band.

13.2 **Existing Users Must Be Vacated from the 2,110–2,145 MHz Band.** Existing users of the 2,110–2,145 MHz spectrum must be moved out *before* broadcasters lose Channels A1 and A2, for the same reason that broadcasters have voluntarily moved fixed, point-to-point links out of the 2 GHz band to higher Television Broadcast Auxiliary bands: namely, to allow the unrestricted use of mobile ENG stations. SBE has heard estimates that there are approximately 13,000 fixed-links in the 2,110–2,145 MHz band, and that the cost of relocating these fixed links to other bands could be as high as 2.5 *billion* dollars.

13.3 **MSS, As the Benefiting Party, Should Pay All Relocation Expenses.** The MSS industry, as the benefiting party, should, of course, pay all costs related to this transition, and ensure that the transition is accomplished by January 1, 2005, or prior to any earlier date the MSS industry would like to see the shift of 1,970–2,010 MHz to MSS occur. SBE wants to see protocols developed, such as the requirement for an MSS proponent to first post a performance bond, to ensure that all reasonable and prudent band-shift expenses are, in fact, paid by the MSS proponent. The requirement for a performance bond will ensure that broadcasters are not left "holding the bag" in the event MSS turns out not to be a financial bonanza, and some MSS auction winners, possibly under-capitalized and having already

spent hundreds of millions of dollars bidding for their MSS spectrum, end up going out of business.

13.4 **Any Changes To ENG Frequencies Must Not Cause Down Time During Critical Time Periods.** If broadcasters must accept shifting of the ENG band, such shifts must be accomplished so as to not cause "down time" during critical evening news time periods, and so as to minimize the duration of down time during non-critical time periods. Broadcasters cannot afford to have an existing and heavily used ENG system out of service for days or weeks during a system changeover.

IV. Possible Alternative To Shifting ENG Band Upwards

14. SBE sees one possible alternative to the admittedly huge cost of shifting the 2 GHz ENG band upwards by 35 MHz. If MSS could accept a lesser amount of spectrum, say, 14 MHz rather than 35 MHz, then reducing each ENG channel by 2 MHz would still leave broadcasters with seven channels (see Paragraph 8.2). The 12% reduction in bandwidth would possibly be tolerable to broadcasters, in exchange for new and state-of-the-art FM video ENG equipment, capable of operating on the narrower channels. SBE estimates the cost of replacement ENG equipment at around 300 million dollars, or about one-eighth of the cost of vacating the 2,110–2,145 MHz band. Of course, such a shift would require massive prior coordination, market-by-market, and itinerant users would have to be provided the means to operate in both shifted and non-shifted markets during the transition period.

15. Any reduced 2 GHz MSS spectrum allocation would, of course, require concurrence at WRC, and a clear acknowledgment by the MSS industry and by the FCC that further loss of ENG spectrum, with additional narrowing and restructuring of 2 GHz ENG channel allocations, would not be again demanded two or three years from now.

16. The MSS industry should not be "let off the hook" and must be forced to pay for all costs associated with new equipment, site leases, and back haul for ENG in the 4 GHz band, should that band be made available to broadcasters as a *quid pro quo* for relinquishing part of its 2 GHz ENG spectrum. An MSS ENG Trust Fund should be established, possibly out of spectrum auction receipts, or financial bonds posted by MSS applicants, before a single MSS license is granted.

V. Summary

17. The 2 GHz ENG Television Broadcast Auxiliary band plays a significant role in bringing live coverage news events to the American public. Broadcasters have already made efficient use of this band by an unprecedented system of voluntary frequency coordination. Loss of 35 MHz of Television Broadcast Auxiliary spectrum would not be in the public interest, and would be inconsistent with the principal that the newcomer make existing users "whole." If broadcasters are nevertheless forced to accept less 2 GHz ENG bandwidth, the MSS industry should pay all costs for the necessary new equipment and compensating and newly available spectrum in the 4 GHz band should be allocated for Television Broadcast Auxiliary use.

Respectfully submitted,

Society of Broadcast Engineers, Inc.

By _____
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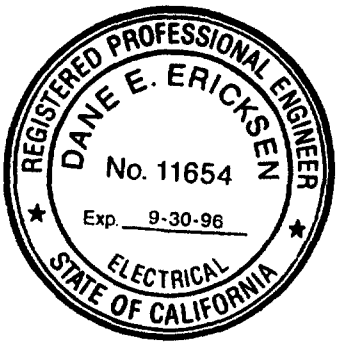

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